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The Relationship Between Financial Inclusion and Sudanese Economic Growth 2006- 2020

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Abstract:

The paper shed light on the causal relationship between financial inclusion, and economic growth in Sudan from 2006 to 2020. The paper seeks to answer the following question: What is the impact of financial inclusion indicators on economic growth in Sudan? Therefore, In order to answer this question, the paper aimed to find out the causal relationship between some indicators of financial inclusion including (the number of ATMs, the number of Sudanese bank branches and the ease of doing business index) in addition to the growth of the Sudanese economy proxies by RGDP to test the causal relationship between the variables of the study, the paper employed the Vector Auto Regression Model (VAR) methodology and also adopted the Angel Granger Causality Test through which the outputs of the Eviews10 showed that the number of bank branches and the ease of doing business index affect the growth of the Sudanese economy, and also showed that there is a relationship between the number of ATMs and economic growth, and accordingly the paper recommended the provision of banking services represented in facilitating the

requirements for opening bank accounts as well as facilitating services for obtaining business licenses, in addition to the delivery of banking services to all regions of Sudan.

Keywords: Financial Inclusion, VAR Model, Economic Growth, Causal Relationship

العلاقة بين الشمول المالي والنمو الاقتصادي في السودان لفترة 2006 - 2020

مزمّل الداعي العباس الفقي

محاضر في قسم الاقتصاد في كلية الاقتصاد والعلوم الاجتماعية بجامعة النيلين - السودان

عصام محمد

الأستاذ التحليل الكمي للاقتصاد في كلية الاقتصاد والعلوم الاجتماعية بجامعة النيلين - السودان

(سّم البحث للنشر في 24 / 4 / 2022م، واعتمد للنشر في 5 / 6 / 2022م)

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الملخص:

تناولت الورقة العلاقة السببية بين الشمول المالي والنمو الاقتصادي في السودان في الفترة 2006-2020م، حيث تكمن مشكلة البحث في السؤال التالي: ما أثر مؤشرات الشمول المالي على النمو الاقتصادي في السودان؟. وللإجابة على هذا السؤال هدفت الورقة إلى معرفة العلاقة السببية بين بعض مؤشرات الشمول المالي (عدد ماكينات الصراف الآلي وعدد أفرع المصارف السودانية ومؤشر سهولة أداء الأعمال) ونمو الاقتصاد السوداني. ولاختبار العلاقة السببية بين متغيرات الدراسة استخدم الباحث منهجية (Vector Auto regression Model) وكذلك استخدم اختبار غرانجر (Angel Granger Causality Test)، حيث أظهرت مخرجات برنامج Eviews10 أن عدد أفرع

البنوك ومؤشر سهولة أداء الأعمال يؤثران على نمو الاقتصاد السوداني، كما أظهرت أن هناك علاقة سببية بين عدد ماكينات الصرف الآلي والنمو الاقتصادي والعكس، وعليه أوصت الورقة بتوفير الخدمات المصرفية متمثلة في تسهيل متطلبات فتح حسابات مصرفية وكذلك تسهيل خدمات الحصول على تراخيص الأعمال، هذا فضلاً عن إيصال الخدمات المصرفية إلى كافة أقاليم السودان.

الكلمات المفتاحية: الشمول المالي، النمو الاقتصادي، العلاقة السببية، نموذج

VAR

1. Introduction

The economic growth, economic development, and poverty issues have remained the topics of concern for long ago concerning both developing nations as well as the well-developed. As a result many countries have tried various methods and policies to resolve the issues of poverty around the world, one of these countries adopted fiscal and monetary instruments to alleviate the number of poor, while others have followed financial policies through financing the low-income groups in order to flourish the economy, and improve the standards of living of a lot of people who live under the line of poverty which is less than two dollars a day⁽¹⁾.

Global and national-level policy makers have been embracing financial inclusion as a crucial development priority for instance the group of 20 have made the topic one of its pillars at the 2009 Pittsburgh Summit G20 2009⁽²⁾. Thus, financial inclusion has been given a great attention for its contribution to economic and financial development while fostering more inclusive growth and greater income equality. Although substantial progress has been made, there is still much to achieve. East Asia, the Pacific, and South Asia combined account for 55% of the world's unbanked adults, mainly in India and China⁽³⁾. Today, every economy expects to reach sustainable development through competition within the global economy. The United Nations have set 17 sustainable development goals (SDGs) for 2030 under the five broad aspects of people, planet, prosperity, peace, and partnership the main focus of prosperity is to assure a prosperous living status for all human beings with economic, social, and technological advancements that are favorable to the environment⁽⁴⁾.

Poverty and income inequality are considered a stubborn challenge in Asia and the Pacific despite the region's rapid economic expansion in previous decades, which lifted millions out of poverty. Financial inclusion is often considered as a critical element that makes growth inclusive as access to finance can enable economic agents to make longer-term consumption and investment decisions, participate in productive activities, and cope with unexpected short-

(1) Francisco G. Villarrea, "Financial inclusion of small rural producers", ECLAC Books, No. 147 (LC/PUB.2017/15-P), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), (2017): pp 30-32

(2) Cull, Robert, Cull, Robert, Tilman Ehrbeck, and Nina Holle, "Financial Inclusion and Development: Recent Impact Evidence." Focus Note 92. Washington, D.C. CGAP. 2014: p 1

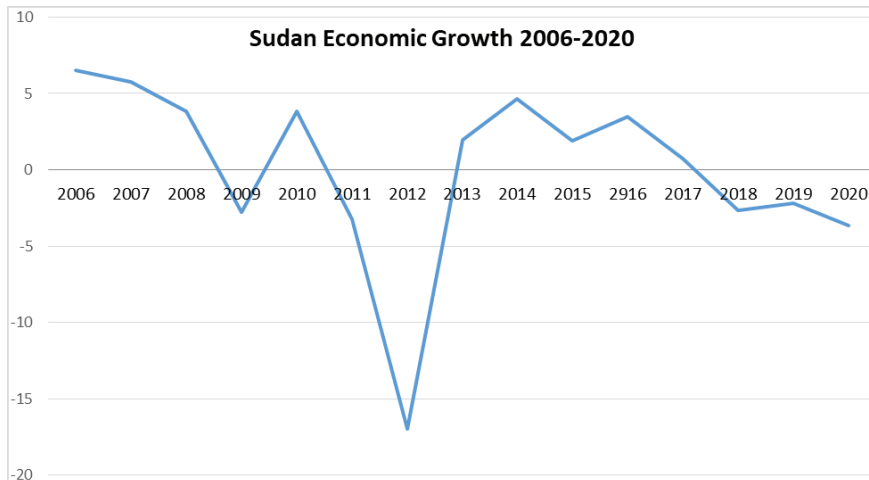
(3) N. Yoshino, and Morgan, N. Yoshino, and Morgan, P. "Overview of Financial Inclusion, Regulation, and Education". ADBI Working Paper 591. Tokyo: Asian Development Bank Institute. (2016): p 2

(4) Thathsarani, U. Wei, J.; Samaraweera, G Financial Inclusion's Role in Economic Growth and Human Capital in South Asia: An Econometric Approach Sustainability (2021): p2

term shocks⁽⁵⁾. These experiences have motivated the researcher to measure the link between financial inclusion indicators and economic growth in Sudan from 2006 to 2020 for Sudan is considered one of the developing countries that encounters economic and financial crisis. Consequently, over 70 per cent of the population are excluded from getting access to financial services and remain unbanked. Therefore, the problem of this paper is based on answering the major question: what is the relationship between financial inclusion and economic growth in Sudan during 2006-2020? Since the main objective of this paper is to examine the impact of financial inclusion on economic growth in Sudan in addition to knowing the causal relationship between financial inclusion and economic growth.

Sudanese Economic Growth in Figures 2006 - 2020

Figure 1, Sudan Economic Growth Rates 2006- 2020



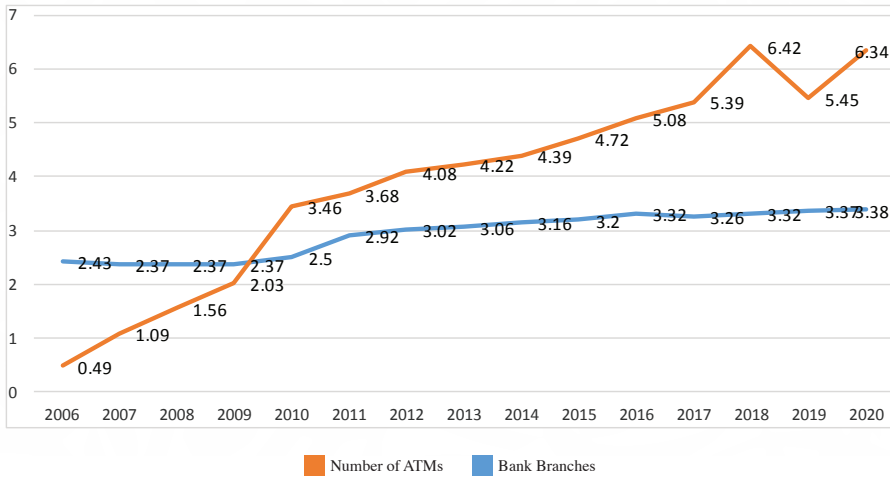
Source: World Bank reports 2006-2020, (<https://data.worldbank.org/country/sudan>)

The figure shows the growth rate of Sudanese economy from 2006 to 2020, the figure reveals that the deterioration of the Sudanese economic growth in 2006, whilst it reached its highest value 6.531 %, while decreased in the following years. In 2009 the growth rate decreased to 2,768 % then raised to

(5) Cyn- Young Park, and Rogelio V. Mercado, Jr., "Financial Inclusion, Poverty, and Income Inequality in Developing Asia" ADB Economics Working Paper Series, Asian Development Bank. (2015): p1

3.85 percent in 2010. We also noticed that the economy deteriorated in 2012, due to Sudan losing 75% of its oil revenues as a result of the secession of South Sudan, and in 2014 the growth of the Sudanese economy reached its highest value of 4.6%, while it declined to 3.63 % in 2020.

Figure 2, Number of ATMs & Number of Bank Branches 2006 -2020



Source: International Monetary Fund via WorldBank (<https://data.worldbank.org/country/sudan>)

The figure (2) shows the number of Automated Teller Machines per 100,000 people- shown in the upper curve, and the number of bank branches in Sudan 2006-2020- shown in the lower curve. The figure reveals that there is a steady increase in both bank branches and ATMs which indicate that the government cares about the development of the financial system in Sudan. Also according to the reports of central Bank of Sudan, the geographical outreach of banks operating in Sudan increased from 522 in 2006 to 655 branches in 2013, and then exceeded 700 branches in various states and regions of Sudan. We also observe that a steady increase in the year 2018 to more than 800 branches, and then jumped to 1,013 branches in 2020 in all states.

2. Empirical Literature Review

Financial inclusion definition is straight forward definition. So, The Asian Development Bank defined the financial inclusion as the provision of financial services such as deposits, loans, payment services, movement of money

to low-income groups⁽⁶⁾ Also, Badr & Shaista defined the term financial inclusion as “the process of ensuring access to financial services timely and adequate credit where needed by vulnerable groups such as weaker sections and low-income groups at an affordable cost”⁽⁷⁾ Also, Nirvikar Singh defines the financial inclusion as that individuals and businesses have access to useful and affordable financial products and services that meet their needs- transactions, payments, savings, credit, and insurance delivered responsibly and sustainably⁽⁸⁾

Study by Mahmood Ahmad et al examined the impact of digital financial inclusion and human capital on china’s economic growth, their study focused on a new proxy of digital financial inclusion based on the breadth of coverage, depth of usage, and digitalization level. They used fixed effect model to test the relationship between the variables, their empirical results show that digital financial inclusion and human capital have significant effect on China’s provincial economic growth, they recommended that investment in human capital development and digital financial inclusion should be put in consideration⁽⁹⁾.

Also Rajabrata B. et al examined the effects of financial inclusion on the economic growth, the study mainly focused on the Access, usage, and quality of financial services. They empirically examined the relationship with specific development outcomes. They have constructed hybrid methodology. They show that financial inclusion has a positive effect on the development outcomes including health, and education⁽¹⁰⁾. Suman Dahiya, and Manoj Kumar, investigated the link between financial inclusion and economic growth in India, they used three dimension including (usage, penetration, and accessibility) from 2005-2017, by using Bayesian Vector Autoregressive Model to explore the relationship. Their study shows that there is a positive relationship between financial inclusion and economic growth⁽¹¹⁾. Dharmendra Singh and Nikola Stakic, tested the relationship between financial inclusion Index and economic growth in eight south Asian Association for Regional

(6) Anand S. Kodan, and Kuldip S. Chhikara. “a Theoretical and Quantitative Analysis of Financial Inclusion and Economic Growth.” *Management and Labour Studies*. (2013): p106

(7) Badr & Shaista. “Role Of Banks In Financial Inclusion In India” (2017): p1. retrieved from www.sciencedirect.com

(8) Singh, Nirvikar, “Financial inclusion: concepts, issues and policies for India”, Munich personal RePec Archive, university of California, Santa Cruz. No.910217. (2019): p 1

(9) Mahmood Ahmad et al. “Digital financial inclusion and economic growth: provincial data analysis of China”, *china economic journal*, (2020): p 1 DOI: 10.1080/17538963.2021.1882064.

(10) Rajabrata B. et al (2020), the effect of financial inclusion on the development outcomes, university of South Australia. Australia, research institute.

(11) Suman Dahiya, and Manoj Kumar. “the linkage between Financial Inclusion and Economic Growth: An Empirical Study of Emerging Indian Economy”, *journals*. (2020): p 1 sagepub.com/home/vis.

corporation (SAARC) countries from 2004-2017, they adopted Pedroni Panel co-integration test, and co-integration regression method in addition to two types of methods, one of which is the fully modified ordinary squares and Dynamic Ordinary Least Squares Methods. These approaches proved that there is a long-run relationship between financial inclusion and economic growth in eight Asian states⁽¹²⁾. Simplice A. Asongu et al has assessed the effect of financial access on an income inequality and gender economic inclusion. They focused on 42 sub-Saharan countries in Africa (SSA). They used the generalized method of moments (GMM) and Fixed Effects Regression (FE). They found that there is a negative effect from the role of financial access in modulating the effects of the Palma ratio on female labor force participation, while there is a positive effect of financial access on Gini coefficient of female unemployment. Michael Chukwunaekwu Nwafor, and Aremu Israel Yomi measured the relationship between the financial inclusion and economic growth in Nigeria during 2000-2016, their variables included (financial deepening index expressed by bank credit to GDP, bank deposit, and commercial bank loans), they used two-staged least squares regression. Their findings show that financial inclusion has significant impact on economic growth in Nigeria⁽¹³⁾. A study by N. Yoshino. & Morgan, (2016) assessed the factors that affects the ability of the low-income groups and households to have an access the financial services such as financial literacy, financial education programs, and financial regulatory frameworks. Cyn- Young Park et al, also assessed different macroeconomic factors that have an effect on financial inclusion, their study covered 37 Asian countries. They mainly focused on poverty and income inequality. They found that per capita income, rule of law, and demographic characteristics significantly affect financial inclusion in developing Asia. Their study recommended that financial services should be provided for old-age population, retirement pensions, an enforcement of financial contracts and financial regulatory in order to expand financial inclusion⁽¹⁴⁾. In another study by Asli Demirguc-Kunt et al (2017) have conducted an empirical evidence on how the use of financial products such as payment services, saving accounts, loans, and insurance can contribute to inclusive growth and economic development⁽¹⁵⁾. Thathsarani,

(12) Dharmendra Singh and Nikola Stakic. "Financial Inclusion and Economic Growth Nexus: Evidence From Saarc Countries Modern", South Asia research, Vo. (41) College of Business and Science, Muscat, Oman and Singidunum University, Belgrade, Serbia. (2020): p 1

(13) Michael Chukwunaekwu Nwafor, and Aremu Israel Yomi. "The Nexus between Financial Inclusion and Economic Growth: Evidence from Nigeria", International Journal of Research and Innovation in Social Science (IJRISS) Volume II, Issue IV. (2018):

(14) Cyn- Young Park et al, (2015), op.cit, p2.

(15) Asli Demirguc-Kunt, et al. "Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence." Development Research

U.; Wei, J.; Samaraweera, has used secondary data to address the gap from 2004-2018 in eight countries in Asia, they developed their study by principal component analysis using an econometric approach of panel data with vector error correction models and Granger Causality test. They found that financial inclusion has a long-run impact on human capital development in south Asian countries, and also a short-run positive impact on economic growth⁽¹⁶⁾. Kusuma Ratnawati, the subject matter of his study is to measure the impact of financial inclusion on economic growth in eight Asian countries. His study included three dimensions (access to banking services, banking penetration, and use of banking services), he measured them by using Generalized Method of Moments (GMM) test, he used Ginin coefficient and poverty ratio below the line of poverty as indicators of poverty inequality. Then, He found that there is statistically significant impact of the three dimensions on economic growth⁽¹⁷⁾.

An empirical study carried out by Harley Tega Williams, Adetoso J. Adegoke, Adegbola Dare (2017), investigated the role of financial inclusion in poverty and economic growth in developing countries, they used panel data analysis, their results show that ATM, bank branches and government expenditure were the most robust predictors for financial inclusion on poverty reduction. Moise Bigirimana Xu Hongyi, (2001), they examined the relationship between economic growth and financial inclusion in Rwanda during 2004-2016, they used Autoregressive Distributive Lag approach to test the variables included in their study. Their findings reveal that there is a long-run relationship between financial inclusion and economic growth in Rwanda. Anand S. Kodan, and Kuldip S. Chhikara, (2013), conducted a theoretical and quantitative analysis of financial inclusion and economic growth, they used log-linear regression model to test the variables. Their study revealed that 1 per cent increase in the financial inclusion led to an average 0.142 per cent increase in the volume of human development index. Yan Shena, Wenxiu Hua, C. and James Huengb, examined the relationship between digital financial inclusion and economic growth by using data for 86 countries. Their findings show that digital financial inclusion has a positive impact on economic growth⁽¹⁸⁾. Minhaj Ali et al examined the effect of financial inclusion on the economic growth for 45 ISDB member countries from 2000-2016.

Group Finance and Private Sector Development Team. (2017):

(16) Thattharani, U.; Wei, J.; Samaraweera, G (2021), op.cit, p3.

(17) Kusuma Ratnawati. "the Impact of Financial Inclusion on Economic Growth, Poverty, Income Inequality, and Financial Stability in Asia." Journal of Asian Finance, Economics and Business Vol 7 No 10 (2020), 073-085. (2020):

(18) Yan Shena, Wenxiu Hua, C. and James Huengb Digital Financial Inclusion and Economic Growth: A Cross-country Study, Elsevier Science Direct.

They used panel Vector Autoregressive Model (VAR) and Angel Granger Causality Test. They found that there is a positive effect of financial inclusion on economic growth⁽¹⁹⁾. Daud Mustafa et al, they investigated the impact of finance on economic growth and financial inclusion, they adopted the simultaneous equation model approach with panel data. The major findings show that there is a positive impact exists between financial inclusion and economic growth⁽²⁰⁾. Loan Thi-Hong Van et al conducted a comprehensive insight between financial inclusion and economic growth in emerging markets, their study include number of variables such as population, and human capital proxied by the number of secondary schooling to gross students, they utilized panel econometric technique to estimate the impact of financial inclusion on economic growth. The results show a positive relationship between financial inclusion and economic growth⁽²¹⁾. Nwanne, T. F. I. Ph.D, Hcib, examined the sustainability of financial inclusion in rural areas in Nigeria, the variables included in their study are; deposit banks, microfinance banks, and communication services, in order to test the data, he used descriptive and content analysis. The researcher noticed that the sustainability of financial inclusion to rural residents in Nigeria remain the corner stone for economic growth⁽²²⁾.

Various studies have used different indicators to measure the financial inclusion such as accessibility, usage, and penetration. Availability is measured by the number of bank branches and number of Automated Teller Machines per 100,000 people, and usage is measured by the volume of credit to private sector, and bank deposits, while depth is measure by bank accounts per 1000 people⁽²³⁾

Sudan suffers a lot from economic and financial crises, as a result 10 million people are exposed to hunger and food insecurity, this according to hunger-index which reported by the international organizations⁽²⁴⁾. So, the lack of sufficient financial institutions, barriers to get access to financial services, and

(19) Minhaj Ali et al. "Does financial inclusion enhance economic growth? Empirical evidence from the IsDB member countries." Research-Gate. (2020);

(20) Daud Mustafa et al. "Impact Analysis of Islamic Finance on Financial Inclusion and Economic Growth in Selected Muslim Countries." Lessons For Nigeria International Journal of Economics, By the International Islamic University Malaysia. (2018): p1

(21) Loan Thi-Hong Van et al. Financial Inclusion and Economic Growth: International Evidence, Emerging Markets Finance and Trade, DOI: 10.1080/1540496X.2019.1697672.

(22) Nwanne, T. F. I. Ph.D., Hcib, "Relationship between Financial Inclusion and Economic Growth in Nigerian Rural Dwellers. International Journal of Small Business and Entrepreneurship Research, Vol.3, No.7, De, Published by European Centre for Research Training and Development UK, ISSN 2053-5821(Print). (2019): pp.17-27,

(23) Moise B. and Xu Hongyi. "research on relationship between financial inclusion and economic growth of Rwanda evidence from commercial banks with ARDL.", International Journal of Innovation and Economic Development, (2001): p2

(24) Global Hunger Index report, (2021) www.globalhungerindex.org

the outreach of institutions in the different states of Sudan, will deepen the financial crisis. Consequently, the gap has been widened between the rich and poor due to the lack of fair distribution of income and wealth. Thus, we find that the contribution of this paper to the literature will be of a great importance to previous studies published in various journals, especially with regard to the financial sector in Sudan, since the research in this field is somehow limited in Sudan.

3. Data and Methodology

Secondary data were collected from the central bank of Sudan annual reports, besides the World Bank reports, and IMF reports. The paper used three financial inclusion indicators due to unavailability of data in Sudan. In order to capture the relationship between financial inclusion indicators and economic growth in Sudan, the paper adopted the Auto-regression approach, for it does not require much knowledge, it requires only list of variables which can be hypothesized to affect each other over time. Each variable in VAR model have an equation modelling its evolution over time.

This equation includes the variable's lagged values. Thus, following the empirical literature, the paper will depend heavily on VAR models to measure the causal relationship between financial inclusion indicators and economic growth in addition to the Granger causality technique to check the direction of the causal relationship between financial inclusion indicators and economic growth whether it is unidirectional or bidirectional relationship.

4. Model Specification

$$RGDP_t = \beta_0 + \beta_1 ATM_{t-1} + \beta_2 bankbranch_{t-1} + \beta_3 doings_{t-1} + \beta_4 RGDP_{t-1} + \varepsilon_{it} \quad (1)$$

$$ATMs_t = \beta_0 + \beta_1 RGDP_t + \beta_2 bankbranch_{t-1} + \beta_3 doings_{t-1} + \beta_4 ATM_{t-1} + u_i \quad (2)$$

$$Bbranch_t = \beta_0 + \beta_1 ATM_{t-1} + \beta_2 RGDP_{t-1} + \beta_3 doings_{t-1} + \beta_4 branch_{t-1} + v_i \quad (3)$$

$$Doings_t = \beta_0 + \beta_1 ATM_{t-1} + \beta_2 bankbranch_{t-1} + \beta_3 RGDP_{t-1} + \beta_4 doings_{t-1} + e_i \quad (4)$$

The subscripts t refers to time, while $(t-1)$ refers to lags, the dependent variable $RGDP$ represents real GDP used as a proxy for economic growth in Sudan; branches denote the number of bank branches, ATMs denotes Automated Teller Machines per 100,000 people, doings show the ease of doing business.

5. The Empirical Results and Discussion.

Table 1, Descriptive Statistics for the Variables

	DOINGS	RGDP	ATMS	BANKBR
Mean	154.6667	3145.145	3.893333	2.936667
Median	154	30.46	4.22	3.06
Maximum	171	24553.1	6.42	3.38
Minimum	135	23.54	0.49	2.37
Std. Dev.	10.50623	8229.232	1.853651	0.408406
Skewness	-0.0322	2.169951	-0.46913	-0.44761
Kurtosis	2.219943	5.733331	2.123926	1.505205
Jarque-Bera	0.382898	16.44116	1.029904	1.897395
Probability	0.825762	0.000269	0.597529	0.387245
Sum	2320	47177.18	58.4	44.05
Sum Sq. Dev.	1545.333	9.48E+08	48.10433	2.335133
Observations	15	15	15	15

Source: Output of Eviews

The paper started the analysis by the descriptive statistics which show that the mean of the variable doings – ease of doing business- is 154.6 while the mean for the variable ATMs is 3.89, in addition to the mean of the variable bankbr- bank branches- is 2.9, proving that doings and ATMs have the highest mean among other variables.

6. Unit Root Test:

In order to decide whether the variables are stationary or not, we run a unit root test mainly focused on Augmented Dickey Fuller test, the outcome of this test is shown in table (2) which show that data series of RGDP is stationary at I (1), as well as the ATMs and doings are stationary at I (1), except the data series of Bank branches is stationary at the first difference with trend and intercept.

Table 2, Stationarity Test for Variables by Augmented Dickey Fuller Test Statistic:

Variables			Level		First difference (with intercept)		First difference (with Trend & intercept)	
			ADF statistics	Result*	ADF statistics	Result*	ADF statistics	Result*
RGDP	t-statist	-4.005	-2.959029	Non stationary	-4.005936	Stationary	---	---
	P(value)	0.002						
Bankbr	t-statist	-6.9606	-0.698333	Non-stationary	---	---	-6.960641	Stationary
	P(value)	0.0017						
D(ATM(-1))	t-statist	-5.2111	-2.142978	Non-stationary	-5.211115	Stationary	---	---
	P(value)	0.0003						
D(Doings(-1))	t-statist	-3.9670	-1.164851	Non-stationary	-3.967099	Stationary	---	---
	P(value)	0.00022						

Source: Output of Eviews

* indicates the results of the ADF test

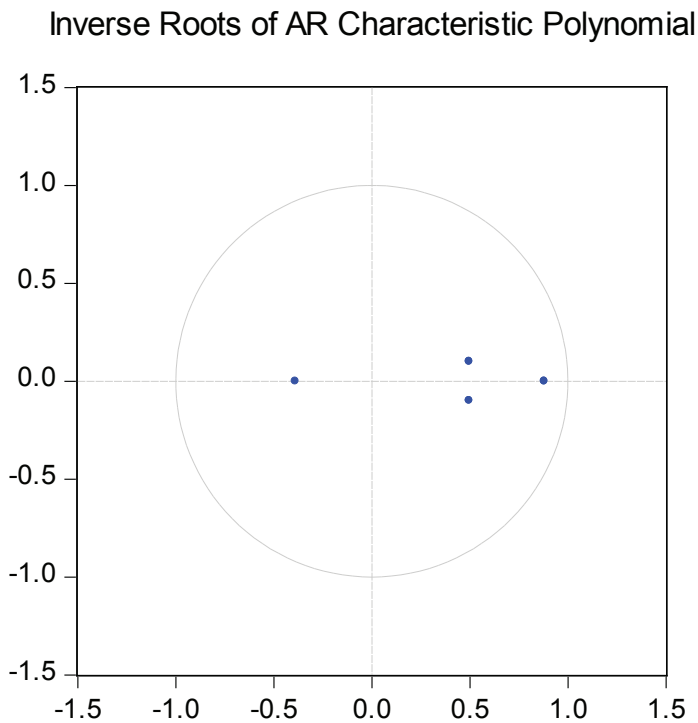
Table 3, Vector Auto Regression Estimates VAR for the Variables

	ATMS	RGDP	BANKBR	DOINGS
ATMS (-1)	-0.385498 (0.28354)	-0.89999 (0.88003)	0.141862 (0.07678)	-5.242 (6.68212)
	[-1.35958]	[-1.02269]	[1.84774]	[-0.78448]
ATMS (-2)	0.383311 (0.31106)	-1.63139 (0.96544)	0.050142 (0.08423)	0.565608 (7.33068)
	[1.23227]	[-1.68978]	[0.59531]	[0.07716]
RGDP (-1)	-0.0000417 (2.3E-05)	-0.00038 (7.1E-05)	3.04E-06 (6.2E-06)	-0.00067 (0.00054)
	[-1.82485]	[-5.31713]	[0.49010]	[-1.24331]
RGDP (-2)	-0.0000679 (2.4E-05)	-0.00014 (7.5E-05)	-0.0000148 (6.5E-06)	-0.00043 (0.00057)
	[-2.81900]	[-1.80549]	[-0.22722]	[-0.75949]
BANKBR (-1)	-0.709221 (1.35069)	-4.09991 (4.19212)	0.415818 (0.36573)	-40.2617 (31.8312)
	[-0.52508]	[-0.97800]	[1.13695]	[-1.26485]
BANKBR (-2)	2.083487 (0.93254)	14.97990 (2.89431)	-0.224152 (0.25251)	56.93285 (21.9768)
	[2.23421]	[5.17563]	[-0.88770]	[2.59059]
DOINGS (-1)	0.032918 (0.01505)	0.226981 (0.04672)	0.001194 (0.00408)	0.584356 (0.35479)
	[2.18657]	[4.85783]	[0.29292]	[1.64707]
DOINGS (-2)	0.014397 (0.01655)	0.104828 (0.05137)	-0.006377 (0.00448)	0.178759 (0.39003)
	[0.86990]	[2.04077]	[-1.42310]	[0.45832]
C	-6.299849 (4.64498)	-39.8827 (14.4166)	2.487495 (1.25775)	14.55756 (109.467)
	[-1.35627]	[-2.76644]	[1.97774]	[0.13299]
R-squared	0.984436	0.983042	0.982426	0.854808
Adj. R-squared	0.953309	0.949125	0.947277	0.564423
Sum sq. resids	0.399982	3.852986	0.029326	222.1441
S.E. equation	0.316221	0.981451	0.085625	7.452250
F-statistic	31.62609	28.98400	27.95044	2.943710
Log likelihood	4.182157	-10.5416	21.16623	-36.8957
Akaike AIC	0.741207	3.006392	-1.871727	7.060869
Schwarz SC	1.132325	3.397510	-1.480609	7.451988
Mean dependent	4.370769	31.31385	3.019231	155.0000
S.D. dependent	1.463435	4.351273	0.372904	11.29159

Source: Output of Eviews

As depicted in table (3) the value of R2 is 0.98, 0.98, 0.98, 0.85 respectively which show that the financial inclusion indicators have strong effect on the economic growth that proxies by the RGDP, in addition to the value of the adjusted R2 of the variables are close to R-square that prove the fitness of the model.

Figure 3, Inverse Roots of AR Characteristic Polynomial



Source: Output of Eviews

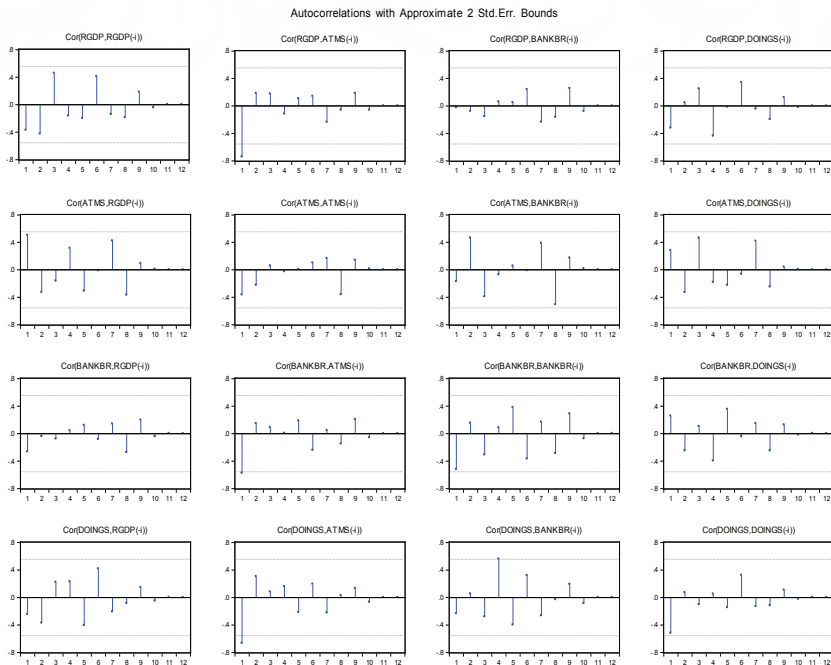
Table 4, Normality Test

Root	Modulus
0.881240	0.881240
0.498324 - 0.099570i	0.508174
0.498324 + 0.099570i	0.508174
-0.389461	0.389461

Source: Output of Eviews

The figure no (3), and the table no (4) revealed that the VAR technique does satisfy the stability condition since all values in the table are less than 1, and no root lies outside the unit circle.

Figure 4, Residual Normality Test



Source: Output of Eviews

Table 5, Autocorrelation LM Test

Lag	LRE* stat	Df	Prob.	Rao F-stat	df	Prob.
1	17.71817	16	0.3407	1.108507	(16, 6.7)	0.4742
2	12.55607	16	0.7049	0.629471	(16, 6.7)	0.7896

Source: Output of Eviews

Table 6, No Serial Correlation at Lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	17.71817	16	0.3407	1.108507	(16, 6.7)	0.4742
2	NA	32	NA	NA	(32, NA)	NA

Source: Output of Eviews

The p-value in table (6) is greater than 0.05 percent. Therefore, it is prove that there is no autocorrelation between the residuals.

Table 7, Residual Test

Component	Skewness	Chi-sq	df	Prob.*
1	0.82117	1.461027	1	0.2268
2	1.142352	2.827429	1	0.0927
3	0.99724	2.154725	1	0.1421
4	1.522649	5.023332	1	0.025
Joint		11.46651	4	0.0218
Component	Kurtosis	Chi-sq	df	Prob.
1	2.770742	0.02847	1	0.866
2	4.449708	1.138396	1	0.286
3	3.691489	0.259002	1	0.6108
4	5.643052	3.783935	1	0.0517
Joint		5.209803	4	0.2664
Component	Jarque-Bera	df	Prob.	
1	1.489497	2	0.4749	
2	3.965825	2	0.1377	
3	2.413727	2	0.2991	
4	8.807268	2	0.0122	
Joint	16.67632	8	0.0337	

Source: Output of Eviews

In order to check whether the data is normally distributed, we run the Jarque-Bera statistic. In table (7) represents the statistical measures used for normality test. Thus, the table (7) shows that the value of skewness is skewed to the left in component 1 and 3, while component 2 and 4 are skewed to the right. As for the Kurtosis value which is between 0-3 indicates the data are normally distributed. In table (7) the total p-value of Jarque-Bera is 0.0337 which is than 0.05 % and the tabulated chi-square is 15.51%. We reject the null hypothesis and accept the alternative hypothesis which mean that the residual are normally distributed.

**Table 8, Heteroscedasticity (No Cross Term)
VAR Residual Heteroscedasticity Tests (Levels and Squares)**

Chi-sq	df	Prob.
79.63772	80	0.4904

Source: Output of Eviews

Since the p-value is greater than 0.05 percent, then we reject the null-hypothesis. Then, the table proves that there is no heteroscedasticity problem. Then, we accept the estimated model.

Figure 5, Responses and Impulse Function Source: output of Eviews

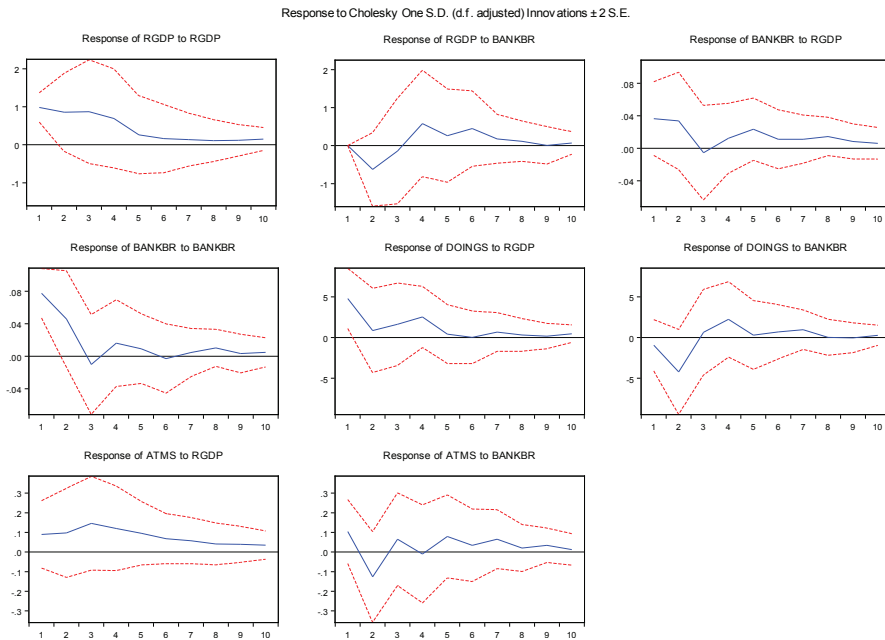


Table 9, Impulse and Responses Function of the Variables

Period	Response of RGDP to RGDP		Response of RGDP BANKBR		Response of RGDP DOINGS		Response of RGDP ATMS	
	RGDP	BANKBR	RGDP	BANKBR	RGDP	Bankbra	RGDP	Bankbra
1	0.981451 (0.19248)	0.000000 (0.00000)	0.036437 (0.02265)	0.077485 (0.01520)	4.789494 (1.84112)	-0.9509 (1.57247)	0.089793 (0.08592)	0.104619 (0.08155)
2	0.856550 (0.51400)	-0.627673 (0.48390)	0.033612 (0.03000)	0.045926 (0.02961)	0.860384 (2.58860)	-4.22375 (2.59903)	0.097162 (0.11368)	-0.126586 (0.11545)
3	0.870998 (0.68390)	-0.142478 (0.69492)	-0.005422 (0.02904)	-0.009965 (0.03065)	1.620632 (2.52916)	0.647393 (2.62711)	0.146216 (0.11938)	0.065067 (0.11824)
4	0.693225 (0.65180)	0.581085 (0.69972)	0.012275 (0.02151)	0.016156 (0.02668)	2.520248 (1.87628)	2.226830 (2.31277)	0.120392 (0.10776)	-0.010303 (0.12492)
5	0.263127 (0.51419)	0.260730 (0.61414)	0.023405 (0.01912)	0.009285 (0.02140)	0.410303 (2.11632)	0.289698 (0.08109)	0.095840 (0.08109)	0.079302 (0.10591)
6	0.162396 (0.44902)	0.448394 (0.49653)	0.011030 (0.01817)	-0.002883 (0.02128)	1.80959 (0.012066)	0.691376 (1.66812)	0.067910 (0.06374)	0.034101 (0.09225)
7	0.133561 (0.34720)	0.177934 (0.32143)	0.011178 (0.01480)	0.004513 (0.01480)	1.61292 (0.666803)	0.966153 (1.21224)	0.057777 (0.05878)	0.065533 (0.07502)
8	0.109160 (0.27598)	0.115345 (0.26550)	0.014496 (0.01175)	0.010274 (0.01141)	1.18577 (0.305137)	0.017780 (1.10482)	0.040918 (0.05332)	0.020321 (0.05976)
9	0.116022 (0.20745)	0.005532 (0.24690)	0.008336 (0.01080)	0.003289 (0.01188)	1.00458 (0.78144)	-0.04321 (0.91500)	0.039011 (0.04586)	0.033881 (0.04389)
10	0.151239 (0.15215)	0.068811 (0.14850)	0.006058 (0.00969)	0.004725 (0.00898)		0.264266 (0.61683)	0.034857 (0.03608)	0.012626 (0.04004)

Source: Output of Eviews

Figure (3) and table (9) reports the impulse and responses function that traces the effect of one-time shock to one of the innovations on the current and future values of the endogenous variables if the innovations (et) are contemporaneously uncorrelated.

Table 10, VAR Granger Causality/ Block Exogeneity Wald Tests

Included observations: 13			
Dependent variable: RGDP			
Excluded	Chi-sq	df	Prob.
BANKBR	27.3355	2	0.000
DOINGS	34.69242	2	0.000
ATMS	3.747326	2	0.1536
All	146.2246	6	0.000
Dependent variable: BANKBR			
Excluded	Chi-sq	df	Prob.
RGDP	0.305995	2	0.8581
DOINGS	2.028466	2	0.3627
ATMS	3.673377	2	0.1593
All	14.22639	6	0.0272
Dependent variable: DOINGS			
Excluded	Chi-sq	df	Prob.
RGDP	2.018454	2	0.3645
BANKBR	6.912729	2	0.0315
ATMS	0.628429	2	0.7304
All	11.75869	6	0.0676
Dependent variable: ATMS			
Excluded	Chi-sq	df	Prob.
RGDP	10.70824	2	0.0047
BANKBR	5.036159	2	0.0806
DOINGS	6.880735	2	0.0321
All	16.75313	6	0.0102

Source: Output of Eviews

According to the statistics in table (10) we observe that bank branches (bankbra) and the variable doings do cause Real Gross Domestic Product (RGDP) since their p-value is less than 0.05 percent. Also the variables ATMs, RGDP, and Doings do not cause bank branches (bankbra) because the p-value is greater than 0.05 percent, that means there is a unidirectional relationship between bank branches and RGDP because bank branches does cause RGDP but RGDP does not cause bank branches.

As for the dependent variable (Doings), the table (10) reveals that bank branches cause doings (ease of doing business) since the p-value do not exceed 0.05 percent.

Finally, the dependent variable ATMs, the table shows that RGDP and doings do cause ATMs because the p-value is smaller than 0.05 %, meaning that the relationship between RGDP and ATMs is a unidirectional relationship because the effect is from only one side that Doings cause ATMs but ATMs does not cause Doings.

Estimated Equation Ordered by Lag:

$$\text{RGDP} = C(1)*\text{RGDP}(-1) + C(2)*\text{BANKBR}(-1) + C(3)*\text{DOINGS}(-1) + C(4)*\text{ATMS}(-1) + C(5)*\text{RGDP}(-2) + C(6)*\text{BANKBR}(-2) + C(7)*\text{DOINGS}(-2) + C(8)*\text{ATMS}(-2) + C(9)$$

$$\text{BANKBR} = C(10)*\text{RGDP}(-1) + C(11)*\text{BANKBR}(-1) + C(12)*\text{DOINGS}(-1) + C(13)*\text{ATMS}(-1) + C(14)*\text{RGDP}(-2) + C(15)*\text{BANKBR}(-2) + C(16)*\text{DOINGS}(-2) + C(17)*\text{ATMS}(-2) + C(18)$$

$$\text{DOINGS} = C(19)*\text{RGDP}(-1) + C(20)*\text{BANKBR}(-1) + C(21)*\text{DOINGS}(-1) + C(22)*\text{ATMS}(-1) + C(23)*\text{RGDP}(-2) + C(24)*\text{BANKBR}(-2) + C(25)*\text{DOINGS}(-2) + C(26)*\text{ATMS}(-2) + C(27)$$

$$\text{ATMS} = C(28)*\text{RGDP}(-1) + C(29)*\text{BANKBR}(-1) + C(30)*\text{DOINGS}(-1) + C(31)*\text{ATMS}(-1) + C(32)*\text{RGDP}(-2) + C(33)*\text{BANKBR}(-2) + C(34)*\text{DOINGS}(-2) + C(35)*\text{ATMS}(-2) + C(36)$$

The Estimated Model:

$$\text{RGDP} = -0.000377\text{RGDP}(-1) - 0.00013\text{RGDP}(-2) - 4.099\text{BANKBR}(-1) + 14.97\text{BANKBR}(-2) + 0.226\text{DOINGS}(-1) + 0.104\text{DOINGS}(-2) - 0.899\text{ATMS}(-1) - 1.631$$

ATMS(-2) - 39.882650364

+ 2.48749531284

Bankbra = 3.035rgdp(-1) - 1.481 rgdp (-2) + 0.415 bankbr(-1) - 0.224 bankbr(-2) + 0.001 doings (-1)

- 0.006 doings (-2) + 0.141 atms (-1) + 0.050 atms (-2) + 2.4874

Doings = - 0.00067 rgdp(-1) - 0.00043 rgdp (-2) - 40.261 bankbr(-1) + 56.932 bankbr(-2)

+ 0.584 doings(-1) + 0.178 doings(-2) - 5.2419 atms (-1) + 0.565 atms (-2) + 14.5575574672

ATMs = - 4.173 rgdp(-1) - 6.789 rgdp(-2) - 0.709 bankbr(-1) + 2.083 bankbr(-2) + 0.0329 (-1)

(-2) - 6.29984883304 – atms (-1) + 0.383 atms (-2) - 0.385 doings + 0.0143 39.8827

Table 11, Estimation Method: Least Squares

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.00038	0.000071	-5.31713	0.0001
C(2)	-0.00014	7.47E-05	-1.80549	0.0898
C(3)	0.226981	0.046725	4.857825	0.0002
C(4)	0.104828	0.051367	2.040767	0.0581
C(5)	-4.09991	4.192125	-0.978	0.3426
C(6)	14.9799	2.894314	5.175631	0.0001
C(7)	-0.89999	0.880026	-1.02269	0.3217
C(8)	-1.63139	0.965441	-1.68979	0.1105
C(9)	-39.8827	14.4166	-2.76644	0.0138
C(10)	-0.00067	0.000539	-1.24331	0.2317
C(11)	-0.00043	0.000568	-0.75949	0.4586
C(12)	0.584356	0.354786	1.647067	0.119
C(13)	0.178759	0.390032	0.458318	0.6529
C(14)	-40.2617	31.83119	-1.26485	0.224
C(15)	56.93285	21.9768	2.590589	0.0197
C(16)	-5.242	6.682115	-0.78448	0.4442
C(17)	0.565608	7.33068	0.077156	0.9395
C(18)	14.55756	109.4666	0.132986	0.8959
C(19)	3.04E-06	6.19E-06	0.490098	0.6307
C(20)	-1.5E-06	6.52E-06	-0.22722	0.8231
C(21)	0.001194	0.004076	0.292924	0.7733
C(22)	-0.00638	0.004481	-1.4231	0.1739
C(23)	0.415818	0.365733	1.136945	0.2723
C(24)	-0.22415	0.252508	-0.8877	0.3879
C(25)	0.141862	0.076776	1.847736	0.0832
C(26)	0.050142	0.084228	0.595309	0.56
C(27)	2.487495	1.257746	1.977741	0.0654
C(28)	-4.2E-05	2.29E-05	-1.82485	0.0868
C(29)	-6.8E-05	2.41E-05	-2.819	0.0123
C(30)	0.032918	0.015055	2.186568	0.044
C(31)	0.014397	0.01655	0.869904	0.3972
C(32)	-0.70922	1.350689	-0.52508	0.6067
C(33)	2.083487	0.932539	2.234208	0.0401
C(34)	-0.3855	0.283541	-1.35958	0.1928
C(35)	0.383311	0.311062	1.232267	0.2357
C(36)	-6.29985	4.644984	-1.35627	0.1938
Determinant residual covariance		0.000133		

Source: Output of Eviews

Table 12, Observations: 13

R-squared	0.854808	Mean dependent var	155
Adjusted R-squared	0.564423	S.D. dependent var	11.29159
S.E. of regression	7.45225	Sum squared resid	222.1441
Durbin-Watson stat	2.997452		

Source: Output of Eviews

Table 13, Observations: 13

R-squared	0.982426	Mean dependent var	3.019231
Adjusted R-sq	0.947277	S.D. dependent var	0.372904
S.E. of regression	0.085625	Sum squared resid	0.029326
Durbin-Watson stat	3.010681		

Source: Output of Eviews

Table 14, Observations: 13

R-squared	0.984436	Mean dependent var	4.370769
Adjusted R-	sq 0.953309	S.D. dependent var	1.463435
S.E. of regression	0.316221	Sum squared resid	0.399982
Durbin-Watson stat	2.728634		

Source: Output of Eviews

7. Conclusion and policy implications:

The deterioration in economic growth rates in Sudan is ascribed to the low level of real production as a result the gap between the poor and the rich has widened, which became vividly clear through certain economic phenomena such as unemployment, inflation, the deficit of the general budget, and the

deficit of the balance of trade, that in turn led to the deterioration of the value of the Sudanese pound. Through these phenomena, successive governments have adopted fiscal and monetary policies to maintain reasonable rates of unemployment, reduce poverty below the poverty line, and increase the volume of production through inclusive policies. However, there are some countries such as Bangladesh, India, and Southeast Asian countries that have followed an inclusive policy concerned with developing the banking sector and facilitating banking services for all regions without exclusion, such as the spread of banks and the provision of ATM services and points of sale, as well as facilitating the administrative procedures for obtaining business licensing, in addition to facilitating access to credit from the banking sector, and consequently, succeeded in increasing the wheel of financial-economic activity, that surely will be followed by an increase in the individuals' income rates in addition to an increase in the GDP. So, through the so-called financial inclusion, these countries and others succeeded in reducing poverty rates and achieving economic prosperity. Thus, this paper focused on specific variables such as ATMs, Bank branches, and ease of doing business as indicators for financial inclusion. hence, to check the causal relationship between variables, we employed the Vector Auto Regression model combined with the Granger Causality Test which proves that there is a unidirectional relationship between RGDP, ATMs, Bank branches, and doings as shown in table (12) R2 equals 0.85, which means that changes in the dependent variables are due to the independent variables by 0.85%, while 0.15% is ascribed to residuals, which indicates that any increase in ATMs, doings, bank branches will increase the number of people who financially included in the financial system through which the government can provide banking services such as finance especially micro-finance and other financial services. Then, the more financial services provided by the government, the more economic growth occurred due to an increase in economic activity. Therefore, the paper recommended that the central bank of Sudan should improve the financial products to reach the people who they are excluded from financial services to increase the GDPPC and consequently economic growth in Sudan. also, the government should have inclusive policies targeting most of the population by increasing the financial awareness, providing financial services, and facilitating the access and penetration to banks to include at least 80 to 90 % of the population in the banking system.

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Appendix 1

Bankbr*	ATMs*	Doings*	Rgdp **
2.43	0.49	151	22217
2.37	1.09	154	24553.1
2.37	1.56	143	23.54
2.37	2.03	147	28
2.5	3.46	154	29.4
2.92	3.68	154	30.2
3.02	4.08	135	27.3
3.06	4.22	143	28.3
3.16	4.39	149	29.29
3.2	4.72	160	30.46
3.32	5.08	159	34.7
3.26	5.39	168	36.2
3.32	6.42	170	37.9
3.37	5.45	162	36.19
3.38	6.34	171	35.6

Source: * World Bank, <https://data.worldbank.org/country/sudan>

** Central Bank of Sudan annual reports, <https://cbos.gov.sd/en>